**UNITED STATES DISTRICT COURT**
**DISTRICT OF MASSACHUSETTS**

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| **SINGULAR COMPUTING LLC,**<br><br>**Plaintiff,**<br><br>**v.**<br><br>**GOOGLE LLC,**<br><br>**Defendant.** | ) | **Civil Action No.**<br>**19-12551-FDS** |

**MEMORANDUM AND ORDER ON CLAIM CONSTRUCTION**

**SAYLOR, C.J.**

This is an action for patent infringement. Plaintiff Singular Computing LLC holds U.S. Patent Nos. 8,407,273 ("the '273 Patent"), 9,218,156 ("the '156 Patent"), and 10,416,961 ("the '961 Patent"), which each describe a method of "Processing with Compact Arithmetic Processing Element[s]." Singular has sued defendant Google LLC for infringing those patents.[1]

The parties have submitted three disputed terms for claim construction. The Court's construction of those terms is set forth below.

## I. Background

### A. Parties

Singular Computing LLC is a Delaware limited liability company that develops novel computer architectures. (Am. Compl. ¶¶ 1, 6).[2] It owns several patents directed at processors

[1] According to the parties, the Patent Trial and Appeal Board has found the asserted claims of the '961 patent to be invalid. (Pl.'s Mot. Status Conference, ECF No. 324). The Court will therefore limit its discussion to the '273 and '156 patents.

[2] The Court has previously reviewed the facts and technology at the heart of this case in its Memorandum and Order on Defendant's Motion to Dismiss. (ECF No. 51). Facts relevant to the current motion are recapitulated here.

with parts "designed to perform low precision and high dynamic range (LPHDR) arithmetic operations." (*Id.* ¶ 6, 9). It is based in Newton and Cambridge, Massachusetts. (*Id.* ¶ 1).

Google LLC is a Delaware limited liability company. (*Id.*¶ 2). Among other things, it provides consumers with a variety of Internet-based computer services such as Google Search, Google Translate, Google Photos, Google Assistant, and Gmail. (*See id.* ¶¶ 2, 15). The amended complaint alleges that Google has built and used several infringing computer systems for its own data centers. (*Id.* ¶¶ 16-26, 81-132).

**B. <u>Underlying Technology</u>**

The patents at issue in this case generally relate to computer processors or devices that include "processing elements designed to perform arithmetic operations . . . on numerical values of low precision but high dynamic range." ('273 patent col. 2 ll. 11-18). In other words, those LPHDR processing elements often "produce results that frequently differ from exact results" by a margin of error, but "they are capable of operating on inputs and/or producing outputs spanning a range" of numbers that is relatively large. (*See id.* col. 2 ll. 28-39).

According to the patents, conventional central processing units ("CPUs") perform arithmetical operations, such as addition, subtraction, multiplication, and division, with "great precision," which typically requires "on the order of a million transistors." (*Id.* col. 3 ll. 7-22). Although such CPUs "make inefficient use of their transistors," this high-precision architecture remains the norm because "[m]any applications need this kind of precision" and it preserves "software compatibility with earlier designs." (*Id.*; *see also id.* col. 5 ll. 41-62).

Because of the inefficiency of conventional CPU designs, "other kinds of computers have been developed to attain higher performance." (*Id.* col. 3 ll. 31-32). The patent describes a variety of such architectures, including single instruction stream/multiple data stream designs, field programmable gate arrays, and graphics processing units ("GPUs"). (*See generally id.* col.

3 l. 30-col. 5 l. 62). The patent claims that while many of those architectures use lower-precision arithmetic and may have advantages for specialized applications, they suffer from a variety of flaws that either prevent their use for modern general-purpose computing or render them approximately as inefficient as conventional CPU designs. (*See generally id.*).

### C. Patents at Issue

The '273 Patent purports to take a "fundamentally different approach" from prior architectures by incorporating LPHDR processing elements into computer processors or other devices. (*Id.* col. 5 l. 63-col. 6 l. 2). According to the patent, each individual LPHDR processing element is "relatively small," which enables them to be deployed together in "massively parallel" configurations. (*Id.* col. 6 ll. 51-55). And the patent claims that while persons of ordinary skill in the art commonly believe that such "massive amounts of LPHDR arithmetic" are of little use, they "are in fact useful and provide significant practical benefits in at least several significant applications." (*Id.* col. 6 l. 51-col. 7 l. 11). For example, it claims that processors with multiple LPHDR processing elements can efficiently solve a task known as the nearest neighbor problem, which has applications in compressing or comparing various types of data. (*Id.* col. 17 l. 29-col. 21 l. 32).

The '156 Patent is a continuation of the '273 Patent and issued on December 22, 2015. It is also entitled "Processing with Compact Arithmetic Processing Element," and shares a specification with the '273 Patent.

## II. Standard of Review

The construction of claim terms is a question of law, which may in some cases rely on underlying factual determinations. *Teva Pharms. USA, Inc. v. Sandoz, Inc.*, 547 U.S. 318, 322, 324-27 (2015); *see Markman v. Westview Instruments*, 517 U.S. 370, 372 (1996) ("[T]he construction of a patent, including terms of art within its claim, is exclusively within the

province of the court.").

In *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*), the Federal Circuit clarified the proper approach to claim construction and set forth principles for determining the hierarchy and weight of the definitional sources that give a patent its meaning. The guiding principle of construction is "the meaning that the term would have to a person of ordinary skill in the art in question at the time of . . . the effective filing date of the patent application." *Id.* at 1313. Courts thus seek clarification of meaning in "the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art." *Id.* at 1314 (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004)).

### A. <u>The Words of the Claim</u>

The claim-construction analysis normally begins with the claims themselves.[3] The claims of a patent "define the invention to which the patentee is entitled the right to exclude." *Phillips*, 415 F.3d at 1312 (citing *Innova*, 381 F.3d at 1115).

A court may construe a claim term to have its plain meaning when such a construction resolves a dispute between the parties. *See O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*,

[3] In *Phillips*, the Federal Circuit discredited the practice of starting the claim construction analysis with broad definitions found in dictionaries and other extrinsic sources:

> [I]f the district court starts with the broad dictionary definition . . . and fails to fully appreciate how the specification implicitly limits that definition, the error will systematically cause the construction of the claim to be unduly expansive. The risk of systematic overbreadth is greatly reduced if the court instead focuses at the outset on how the patentee used the claim term in the claims, specification, and prosecution history, rather than starting with a broad definition and whittling it down.

415 F.3d at 1321. Of course, if no special meaning is apparent after reviewing the intrinsic evidence, claim construction might then "involve[] little more than the application of the widely accepted meaning of commonly understood words." *Id.* at 1314.

521 F.3d 1351, 1361 (Fed. Cir. 2008); *see also U.S. Surgical Corp. v. Ethicon, Inc.*, 103 F.3d 1554, 1568 (Fed. Cir. 1997) ("Claim construction is a matter of resolution of disputed meanings and technical scope, to clarify and when necessary to explain what the patentee covered by the claims, . . . [but] is not an obligatory exercise in redundancy.").

In some instances, the arrangement of the disputed term in the claims is dispositive. "This court's cases provide numerous . . . examples in which the use of a term within the claim provides a firm basis for construing the term." *Phillips*, 415 F.3d at 1314. For example, because claim terms are normally used consistently throughout the patent, the meaning of a term in one claim is likely the meaning of that same term in another. *Id.* In addition, "the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim." *Id.* at 1315.

**B. <u>The Specification</u>**

"The claims, of course, do not stand alone." *Id*. "Rather, they are part of a fully integrated written instrument, consisting principally of a specification that concludes with the claims." *Id.* (citations and quotation marks omitted). For that reason, the specification must always be consulted to determine a claim's intended meaning. The specification "is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." *Id.* (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)).

"In general, the scope and outer boundary of claims is set by the patentee's description of his invention." *On Demand Mach. Corp. v. Ingram Indus., Inc.*, 442 F.3d 1331, 1338 (Fed. Cir. 2006); *see also Phillips*, 415 F.3d at 1315-17 ("[T]he interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim." (quoting *Renishaw PLC v. Marposs Societa' per Azioni*,

158 F.3d 1243, 1250 (Fed. Cir. 1998))). "[T]he specification may reveal a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess." *Phillips*, 415 F.3d at 1316. It may also reveal "an intentional disclaimer, or disavowal, of claim scope by the inventor." *Id.* Therefore, the claims are to be construed in a way that makes them consistent with, and no broader than, the invention disclosed in the specification. *On Demand*, 442 F.3d at 1340 ("[C]laims cannot be of broader scope than the invention that is set forth in the specification."); *Phillips*, 415 F.3d at 1316 ("[C]laims must be construed so as to be consistent with the specification, of which they are a part." (quoting *Merck & Co. v. Teva Pharms. USA, Inc.,* 347 F.3d 1367, 1371 (Fed. Cir. 2003))).

Nevertheless, courts must be careful to "us[e] the specification [only] to interpret the meaning of a claim" and not to "import[] limitations from the specification into the claim." *Id.* at 1323. A patent's "claims, not specification embodiments, define the scope of patent protection." *Kara Tech. Inc. v. Stamps.com Inc.*, 582 F.3d 1341, 1348 (Fed. Cir. 2009); *see also Martek Biosciences Corp. v. Nutrinova, Inc.*, 579 F.3d 1363, 1381 (Fed. Cir. 2009) ("[E]mbodiments appearing in the written description will not be used to limit claim language that has broader effect."). "In particular, [the Federal Circuit] ha[s] expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment." *Phillips*, 415 F.3d at 1323. This is "because persons of ordinary skill in the art rarely would confine their definitions of terms to the exact representations depicted in the embodiments." *Id.*

Although this distinction "can be a difficult one to apply in practice[,] . . . the line between construing terms and importing limitations can be discerned with reasonable certainty and predictability if the court's focus remains on understanding how a person of ordinary skill in

the art would understand the claim terms." *Id.* "The construction that stays true to the claim language and most naturally aligns with the patent's description of the invention will be, in the end, the correct construction." *Id.* at 1316 (quoting *Renishaw*, 158 F.3d at 1250).

### C. The Prosecution History

After the specification and the claims themselves, the prosecution history is the next best indicator of term meaning. The prosecution history "consists of the complete record of the proceedings before the PTO and includes the prior art cited during the examination of the patent." *Id.* at 1317. "Like the specification, the prosecution history provides evidence of how the PTO and the inventor understood the patent." *Id.* "[T]he prosecution history can often inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it would otherwise be." *Id.* The doctrine of prosecution disclaimer applies equally to statements made during *inter partes* review proceedings before the Patent Trial and Appeal Board, to "ensure that claims are not argued one way in order to maintain their patentability and in a different way against accused infringers." *Aylus Networks, Inc. v. Apple Inc.*, 856 F.3d 1353, 1360 (Fed. Cir. 2017).

However, "because the prosecution history represents an ongoing negotiation between the PTO and the applicant, rather than the final product of that negotiation, it often lacks the clarity of the specification and thus is less useful for claim construction purposes." *Phillips*, 415 F.3d at 1317. As a result, courts generally require that "a patent applicant . . . clearly and unambiguously express surrender of subject matter" to disavow claim scope during prosecution. *Voda v. Cordis Corp.*, 536 F.3d 1311, 1321 (Fed. Cir. 2008) (quoting *Sorensen v. Int'l Trade Comm'n*, 427 F.3d 1375, 1378-79 (Fed. Cir. 2005)); *see Unwired Planet, LLC v. Apple Inc.*, 829 F.3d 1353, 1358 (Fed. Cir. 2016) ("[A] disclaimer or disavowal of claim scope must be clear and

unmistakable, requiring words or expressions of manifest exclusion or restriction in the intrinsic record."). Furthermore, "[p]rosecution history . . . cannot be used to limit the scope of a claim unless the applicant took a position before the PTO that would lead a competitor to believe that the applicant had disavowed coverage of the relevant subject matter." *Schwing GmbH v. Putzmeister Aktiengesellschaft*, 305 F.3d 1318, 1324-25 (Fed. Cir. 2002).

### D. <u>Extrinsic Sources</u>

Extrinsic evidence consists of "all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises." *Phillips*, 415 F.3d at 1317 (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 980 (Fed. Cir. 1995)). It "can help educate the court regarding the field of the invention and can help the court determine what a person of ordinary skill in the art would understand claim terms to mean." *Id.* at 1319. However, extrinsic evidence suffers from a number of defects, including its independence from the patent, potential bias, and varying relevance. *Id.* at 1318-19. Such evidence is therefore "unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the intrinsic evidence," and courts may consider, or reject, such evidence at their discretion. *Id.* at 1319.

## III. <u>Analysis</u>

There are three disputed terms in the patents:

| Claim Term | Google's Proposed Construction | Singular's Proposed Construction |
| --- | --- | --- |
| "repeated execution" | Term fails for indefiniteness | Not indefinite |
| "execution unit" or<br>"LPHDR execution unit" | "low precision and high dynamic range processing element designed to perform arithmetic operations on numerical values" | "LPHDR" as defined in claim;<br>"execution unit" as "processing element comprising an arithmetic circuit paired with a |

| | | |
|---|---|---|
| | | memory circuit” |
| “first input signal representing a numerical value” | “a digital and/or analog representation of a value that the LPHDR execution unit operates on” | Plain and ordinary meaning |

The disputed terms are ubiquitous throughout the asserted patents, as they describe essential aspects of the claimed invention. As relevant here, they appear in Claim 53 of the ’273 patent and Claim 7 of the ’156 patent. To provide context, an excerpt of Claim 53 is set forth below:

> A device:
>
> comprising at least one first low precision high-dynamic range **(LPHDR) execution unit** adapted to execute a first operation on **a first input signal representing a first numerical value** to produce a first output signal representing a second numerical value,
>
> wherein the dynamic range of the possible valid inputs to the first operation is at least as wide as from 1/1,000,000 through 1,000,000 and for at least X = 5% of the possible valid inputs to the first operation, the statistical mean, over **repeated execution** of the first operation on each specific input from the at least X% of the possible valid inputs to the first operation, of the numerical values represented by the first output signal of the LPHDR unit executing the first operation on that input differs by at least Y = 0.05% from the result of an exact mathematical calculation of the first operation on the numerical values of that same input;
>
> wherein the number of LPHDR execution units in the device exceeds by at least one hundred the non-negative integer number of execution units in the device adapted to execute at least the operation of multiplication on floating-point numbers that are at least 32 bits wide.

(’273 patent col. 31 ll. 62-col. 32 l. 18, col. 32 ll. 37-41, 60-62 (emphasis added); *see also* ’156 patent col. 29 ll. 54-67, col. 30 ll. 7-16, 20-22).

The Court will address each term in turn.

### A. <u>"Repeated Execution"</u>

| Claim Term | Google's Proposed Construction | Singular's Proposed Construction |
|---|---|---|
| "repeated execution" | Term fails for indefiniteness | Not indefinite |

Google contends that the term "repeated execution" is indefinite because it fails to apprise a person skilled in the art of the number of executions necessary to determine whether the values outputted by an accused device are sufficiently different from exact mathematical calculations such that the device would infringe the asserted claims.

Section 112 of the Patent Act provides that "[t]he specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention." 35 U.S.C. § 112(b). A patent claim fails to satisfy that requirement and "is invalid for indefiniteness if its claims, read in the light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). That is, "a patent must be precise enough to afford clear notice of what is claimed, thereby apprising the public of what is still open to them." *Id.* at 909 (quotation marks and alterations omitted). Nevertheless, "the definiteness requirement must take into account the inherent limitations of language," for "[s]ome modicum of uncertainty . . . is the 'price of ensuring the appropriate incentives for innovation.'" *Id.* (quoting *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 732 (2002)).

Claim indefiniteness is an issue of law to be decided by the court. *Teva Pharms. USA, Inc.*, 789 F.3d at 1341. To determine whether a claim is indefinite, a court "look[s] to the patent record—the claims, specification, and prosecution history—to ascertain if they convey to one of skill in the art with reasonable certainty the scope of the invention claimed." *Id.* A patent is

presumed to be valid, 35 U.S.C. § 282, and overcoming that presumption requires that a defendant prove indefiniteness by clear and convincing evidence, *Microsoft Corp. v i4i Ltd. P'ship*, 564 U.S. 91, 95 (2011).

According to Google, its contention that the patents are indefinite is grounded upon three premises: (1) that the "repeated execution" claim language describes the "test for measuring whether the LPHDR execution units' operation is sufficiently different from exact mathematical calculations to satisfy the claimed minimum percentage of inaccuracy"; (2) that "the asserted patents include analog embodiments"; and (3) that "analog signals are subject to a phenomenon known as 'noise,' which guarantees that analog systems cannot generate repeatable results when executing a given operation on a particular input." (Google Reply Br. at 3-4).[4]

Based on those premises, Google asserts that because analog systems yield varied results when performing the same operation over multiple executions, calculating the average of those results, and determining the extent to which that average differs from the exact mathematical result, depends upon the number of executions performed. (*See* Google Preliminary Br. at 8-10). For example, the average calculated after two executions may vary considerably from that calculated after ten executions or more. (*Id.*).

The upshot of Google's contention is that whether an accused device infringes the patent may depend on the number of executions the device undertakes. An accused device that performs two operations may yield significantly different output values, resulting in an average output value sufficiently different from the exact mathematical calculation such that the device

[4] Google contends that the "repeated execution" language is inapplicable to digital inputs because those inputs yield deterministic results—that is, identical digital inputs will always yield identical outputs, no matter how many times the execution is repeated. Thus, determining whether a processing element operating upon digital inputs infringes the asserted patents would merely require a single execution, as opposed to "repeated executions."

infringes the asserted claims. However, the continued operation of that device may, over time, produce average results of sufficient accuracy, thereby placing the device outside the claim language. Or, Google asserts, the converse could be true—a processor operating upon analog signals could initially perform precise calculations, but as the device generates heat, thereby introducing analog signal noise, the results may become increasingly unpredictable, resulting in infringement. In either case, according to Google, the patent fails to provide a required number of "repeated executions" from which an average output can be calculated and compared to the exact mathematical result, thereby rendering the limits of the claim language indefinite.

In contrast, Singular contends that the term "repeated execution" is not indefinite because, when read in context with the surrounding claim language, the term informs a person of skill in the art of the claim's scope. Specifically, it contends that the term "repeated execution" is "explicitly tied to finding 'the statistical mean' of the numerical output values." (Singular Reply Br. at 4). According to Singular, Google misleadingly conflates the concepts of "arithmetic average," which may fluctuate dramatically over a small sample size, and "statistical mean," which stabilizes and remains constant over time. (*See id.* at 4-5). The difference between those two concepts, Singular contends, is readily understood by one with a rudimentary understanding of statistics, never mind a person of skill in the art. (*Id.*). As a result, the claim language, taken in context, informs a person of skill in the art that the term "'repeated execution' requires the LPHDR unit to repeatedly execute the 'first operation' as many times as necessary, until a stable average of all numerical values represented by the unit's output signal is reached." (*Id.* at 4). In other words, the claim language requires the performance of as many executions as are necessary to determine the statistical mean.

In support of their contentions, both parties marshal competing expert testimony.

Google's expert, Dr. Gu-Yeon Wei, asserts that the claim term is indefinite because the claim language does not set forth a reliable method for "measuring the difference between LPHDR execution units' results and the 'exact' results of the same operation." (Wei Decl. ¶ 37). According to Wei, repeated execution of a given operation "will not reliably show whether a device meets the claimed levels of difference because each execution can cause the difference between the average and exact result to change in an unpredictable way." (*Id.*). To illustrate that point, he offers a hypothetical of an analog system that performs a basic multiplication operation ten times. Because of the unpredictable results and small sample size, the arithmetic average changes dramatically after each output, potentially causing the device to oscillate between infringement and non-infringement depending on the number of executions performed. (*See id.* ¶¶ 37-43).

In response, Singular offers the testimony of Dr. Sunil Khatri, who states that such a hypothetical is "erroneous as a matter of engineering as well as common sense." (Khatri Decl. ¶ 31). In Khatri's opinion, the claim language is clear because a person of skill in the art "would only have to apply standard statistical analysis to properly characterize the device's output values." (*Id.* ¶ 32). To demonstrate that point, Khatri recreated Wei's hypothetical but expanded it to 1500 repetitions as opposed to 10. (*See id.* ¶ 34). Over the course of repeated executions, Khatri asserts, the average output value "goes from being an arithmetic average that potentially has an unstable value when computed based on a small number of executions, to a stable statistical mean that does not meaningfully fluctuate." (*Id.* ¶ 33).

Moreover, Khatri asserts that a person of skill in the art would understand that "limiting the number of repeated executions to ten would serve no practical purpose, as typical computing devices are capable of performing *billions* of floating-point operations every second." (*Id.* ¶ 30

n.1). Thus, in practicality, a person of skill in the art would be able to determine the "claimed 'statistical mean' in mere microseconds" by "using fundamental statistical analysis." (*Id.* ¶ 34).

In response, Google contends that Khatri's description of "statistical mean" renders the term a subjective term of degree and, therefore, indefinite. Khatri describes a "statistical mean" as an average that does not "materially change" or "meaningfully fluctuate" over time. (*Id.* ¶ 29, 33). He further states that identifying the moment at which the statistical mean has been arrived, such that the average of the outputs sufficiently stabilizes, is a context-specific inquiry—although he did assert that, given specific circumstances, the statistical mean would be readily apparent to one skilled in the art. (*See* Khatri Dep. at 109-113). Google contends that in light of Khatri's articulation of a seemingly subjective standard for identifying a statistical mean, and his failure to bolster his opinion with intrinsic evidence, his opinion offers no guidance as to whether the claim language provides a discernable limit to the claimed invention. (*See* Google Supp. Br. at 5).

Singular contends that Khatri's opinion rests upon basic statistical principles, readily apparent to those skilled in the art, yet ignored by Wei. (*See* Singular's Responsive Supp. Br. at 2-3). Furthermore, Singular contends that Wei's contentions are at odds with representations made by Google before the PTAB, wherein Google construed the disputed claims according to their ordinary and customary meaning. (*See* Seeve Decl. Exs. 2-13).

The parties have not requested that the Court construe the term "repeated execution," or narrow its meaning, other than Google's request that it should find the term to be indefinite as a matter of law. Under the circumstances, the Court finds that Google has not met its burden of proving by clear and convincing evidence that the term is indefinite.

As noted, Google's proof of indefiniteness consists of Wei's opinion that the term

"repeated execution" does not apprise one skilled in the art of the number of executions needed to determine the "statistical mean" of the resulting values. However, Wei did not opine, nor does Google contend, that the term "statistical mean" is indefinite or incomprehensible to a person skilled in the art. Rather, Wei's opinion is, in essence, that the lack of claim language specifying the number of executions needed to discern the statistical mean leaves competitors with "no objective number of repeated executions that would determine whether a device infringes or not[.]" (Wei Decl. ¶ 43). Of course, that issue of fact is by no means uncontroverted. But even if the Court were to find Wei's opinion persuasive, "[t]he test for indefiniteness is not whether infringement of the claim must be determined on a case-by-case basis." *Nevro Corp. v. Boston Sci. Corp.*, 955 F.3d 35, 39 (Fed. Cir. 2020). In other words, "[d]efiniteness does not require that a potential infringer be able to determine *ex ante* if a particular act infringes the claims." *Id.* at 40. Rather, the test for indefiniteness asks whether a claim "inform[s] those skilled in the art about the scope of the invention with reasonable certainty." *Nautilus*, 572 U.S. at 910.

Here, the claim language, read in the context of the term "statistical mean," is sufficiently specific to inform a person of skill in the art of the scope of the claim. The fact that a potentially variable number of repeated executions may need to be performed before one skilled in the art can determine the statistical mean of a given operation does not, without more, render the claim indefinite. *See Enzo Biochem, Inc. v. Applera Corp.*, 599 F.3d 1325, 1336 (Fed. Cir. 2010) ("The claims are not indefinite even if some experimentation is required to determine the exact [scope of the claims.]"); *Exxon Research & Eng'g Co. v. United States*, 265 F.3d 1371, 1379 (Fed. Cir. 2001) ("[T]he fact that some experimentation may be necessary to determine the scope of the claims does not render the claims indefinite.").

As a matter of law, therefore, the Court does not find that the term is indefinite, and the

term otherwise does not require construction.

**B. <u>"Execution Unit"/ "LPHDR Execution Unit"</u>**

| Claim Term | Google's Proposed Construction | Singular's Proposed Construction |
|---|---|---|
| "execution unit" or "LPHDR execution unit" | "low precision and high dynamic range processing element designed to perform arithmetic operations on numerical values" | "LPHDR" as defined in claim;<br>"execution unit" as "processing element comprising an arithmetic circuit paired with a memory circuit" |

The next term disputed by the parties is "LPHDR execution unit" or "execution unit." The parties agree that "execution unit" is properly construed as a "processing element." (*See* Google Preliminary Br. at 13; Singular Reply Br. at 11). There remain, though, three points of contention: (1) whether the adjectival term "low precision and high dynamic range" should be construed as part of the term "execution unit"; (2) whether a processing element "comprises an arithmetic element paired with a memory circuit"; and (3) whether the "execution unit" operates on "numerical values" as opposed to an electrical "input signal."

**1. <u>"Low Precision and High Dynamic Range"</u>**

Although the parties purport to dispute whether the term "execution unit" should be construed to include the term "low precision and high dynamic range," it is by no means clear what is actually disputed about those terms.

Singular contends that the term "low precision and high dynamic range" requires no construction because the term is defined in the claim. (Singular Reply Br. at 12). According to Singular, the term "low precision" is defined by the following claim language:

> . . . for at least X = 5% of the possible valid inputs to the first operation, the statistical mean, over repeated execution of the first operation on each specific input from the at least X% of the possible valid inputs to the first operation, of the numerical values represented by the first output signal of the LPHDR unit

> executing the first operation on that input differs by at least Y = 0.05% from the result of an exact mathematical calculation of the first operation on the numerical values of that same input; . . . .

(Singular Preliminary Br. at 9; ’273 patent col. 32 ll. 3-12). It further contends that the term “high dynamic range” is defined by the claims as “the dynamic range of possible valid inputs to the first operation is at least as wide from 1/1,000,000 through 1,000,000 . . . .” (’273 patent col. 32 ll. 3-12, 60-64). Google’s construction, Singular asserts, would “brush aside definitions of [those] terms that are already present in the claims themselves.” (Singular Preliminary Br. at 10).

Google contends that Singular’s proposed construction would read “low precision and high dynamic range” out of the claims altogether. If the claim language defines “low precision and high dynamic range,” Google asserts, then the term itself is rendered superfluous. (Google Reply Br. at 6). According to Google, the proper construction of claim language would view “low precision and high dynamic range” as having independent meaning that is then further narrowed or clarified by the claim language disclosing specific mathematical ranges. (*Id.*). That is, the term “low precision and high dynamic range” would describe “a genus of execution units,” and the additional claim language would disclose specific species “with different dynamic ranges and error rates.” (*Id.*).

Despite those differing interpretations, though, neither party offers a proposed construction for the term “low precision and high dynamic range.” Nor is it absent from the claim language; the disputed claims disclose a device “comprising at least one first low precision and high dynamic (LPHDR) execution unit . . . .” (’273 patent col. 31 ll. 63-64). Thus, adopting Google’s proposed construction would appear to insert “LPHDR” before “execution unit,” which would be redundant. The claim language, as it is, already provides as such. Therefore, the Court will construe the term “low precision and high dynamic range” as defined in the claim itself.

### 2. <u>**"Arithmetic Circuit Paired with a Memory Circuit"**</u>

Singular proposes that the term "execution unit" should be construed as a "processing element comprising an arithmetic circuit paired with a memory circuit." (Singular Preliminary Br. at 5). That construction, Singular contends, is bolstered by intrinsic evidence—specifically, embodiments of the claimed invention described in the specification. (*Id.* at 5-8; *see* '273 patent col. 10 ll. 36-42, col. 16 ll. 54-56). It also points to extrinsic evidence, in the form of a treatise, that describes a processing element as comprising memory registers. (*Id.* at 8).

Google contends that Singular's construction is inconsistent with the claim language for a variety of reasons. First, it contends that none of the asserted claims refer to memory or use the term "memory circuit," and that to read that limitation into the asserted claims would run afoul of the doctrine of claim differentiation, as dependent claims not asserted here do reference execution units paired with memory. (Google Reply Br. at 7). Second, it contends that Singular's construction is contradicted by the specification, which teaches that the asserted claims must encompass disclosed software embodiments, and therefore cannot be limited to a hardware embodiment, as Singular's construction requires. (*Id.* at 7-9). Finally, it counters Singular's extrinsic evidence with its own, providing an excerpt from a treatise that describes "processing elements" that do not include memory circuits. (*Id.* at 9).

Google's arguments for rejecting Singular's proposed construction are unpersuasive. To begin, Singular's construction of the independent claims is not foreclosed by dependent claims that disclose devices that include "memory locally accessible to at least one of the LPHDR execution units." (*See e.g.*, '273 col. 31 ll. 27-29, col. 33 ll. 56-58, 62-64). It is true that the doctrine of claim differentiation creates a rebuttable presumption that "each claim in a patent has a different scope." *Sunrace Roots Enter. Co., Ltd. v. SRAM Corp.*, 336 F.3d 1298, 1302 (Fed. Cir. 2003) (quoting *Comark Commc'ns, Inc. v. Harris Corp.*, 156 F. 3d 1182, 1187 (Fed. Cir.

1998)). Furthermore, "[t]hat presumption is especially strong when the limitation in dispute is the only meaningful difference between an independent and dependent claim, and one party is urging that the limitation in the dependent claim should be read into the independent claim." *Id.* at 1303. That does not, however, appear to be the case here. The dependent claims cited by Google disclose devices where the memory is "locally accessible" to the LPHDR execution unit, which stand in apparent contrast to a device that pairs an execution unit with non-local memory. Such a device would be excluded by the dependent claims, yet would be encompassed by Singular's construction of the independent claims in dispute. (*See* Singular Reply Br. at 12). The doctrine of claim differentiation, therefore, does not appear to be a proper basis for rejecting Singular's proposed construction.[5]

Google also contends that Singular's proposed construction would contradict the specification because it would impose a hardware limitation upon the claimed invention, even though the specification teaches a potential software embodiment. Such a construction, according to Google, would run contrary to the Federal Circuit's guidance that claims should not be construed in a manner "that excludes embodiments disclosed in the specification." *Oatey Co. v. IPS Corp.*, 514 F.3d 1271, 1276-77 (Fed. Cir 2008). However, that guidance does not require

[5] As evidence that an execution unit can be paired with non-local memory, Singular cites to an excerpt from the patent that reads as follows:

> Embodiments of the present invention may, however, be implemented in devices in addition to or other than processors. For example, a computer including a processor and other components (*such as memory coupled to the processor by a data path*), wherein the processor includes components for performing LPHDR operations in any of the ways disclosed herein, is an example of an embodiment of the present invention.

('273 patent col. 29 ll. 5-12). Google cites to the same excerpt as evidence of an embodiment where memory is *not* paired with the arithmetic circuit, and, therefore, an example of an embodiment excluded by Singular's proposed construction. (Google Reply Br. at 8 ("[T]he description of 'memory . . . coupled by a data path' with a processor is different from the idea of a memory circuit 'paired with' an arithmetic circuit . . . .)). In any event, Google offers no explanation as to why "coupled with a data path" has a substantially different meaning from "paired with."

that all claims encompass every embodiment of an invention. *PSN Illinois, LLC v. Ivoclar Vivadent, Inc.*, 525 F.3d 1159, 1166 (Fed. Cir. 2008). Rather, "courts must recognize that disclosed embodiments may be within the scope of other allowed but unasserted claims." *Id.*

Such is the case here, where the software embodiments of the invention are clearly provided for in other claims. Those claims are prefaced as follows:

> A device comprising a computer processor and a computer-readable memory storing computer program instructions, wherein the computer program instructions are executable by the processor **to emulate** a second device comprising:
>
> at least one first low precision high-dynamic range (LPHDR) execution unit adapted to execute a first operation on a first input signal representing a first numerical value to produce a first output signal representing a second numerical value.

('273 patent col. 31 ll. 33-41; col. 34 ll. 1-9 (emphasis added)).

Thus, the disclosed software embodiments "emulate" the hardware disclosed in the asserted claims—that is, the LPHDR execution unit. Reading a hardware limitation into the asserted claims, then, does not exclude the software embodiments described in the specification, so long as those embodiments emulate an LPHDR execution unit.

Google's contention goes further, though, arguing that the specification teaches that the claimed "LPHDR execution unit" is not even a tangible object at all, but rather an abstract concept. Thus, according to Google, the term "LPHDR execution unit," as taught by the specification, must encompass all possible embodiments, such that "software is covered by every LPHDR execution unit claimed in the asserted patent." (Google Post-Hr'g Br. at 10).

At the heart of Google's argument are two excerpts from the specification. The first excerpt is as follows:

> Although certain embodiments of the present invention are described herein as executing software, this is merely an example and does not constitute a limit on the present invention. Alternatively, for example, embodiments of the present

> invention may be implemented using microcode or a hardware sequencer or state machine or other controller to control the LPHDR arithmetic elements of any of the kinds disclosed herein. Alternatively, for example, embodiments of the present invention may be implemented using hardwired, burned or otherwise pre-programmed controllers to control LPHDR arithmetic elements of any of the kinds disclosed herein.

('273 patent col. 25 ll. 41-52). Google contends the excerpt "indicates that certain embodiments implement the invention in software, not just hardware" and that "Singular's proposed construction is therefore impossible to square with the specification." (Google Preliminary Br. at 16). When read in context, though, the excerpt teaches programmable controllers that control hardware—the LPHDR arithmetic elements. The excerpt does not appear to teach that an LPHDR execution unit is an abstract concept, but rather that software can be utilized in combination with hardware elements to perform the disclosed LPHDR functions. That interpretation is bolstered by the paragraph that follows:

> Although certain embodiments of the present invention are described herein as being implemented using custom silicon as the hardware, this is merely an example and does not constitute a limitation of the present invention. Alternatively, for example, embodiments of the present invention may be implemented . . . using any programmable conventional digital or analog computing architecture (including those which use high-precision computing elements, including those which use other kinds of non-LPHDR hardware to perform LPHDR arithmetic, and including those which are massively parallel) which has been programmed with software to perform the LPHDR operations disclosed herein. For example, embodiments of the present invention may be implemented using a software emulator of the functions disclosed herein.

('273 patent col. 25 l. 53-col. 26 l. 4). Thus, the specification teaches that software can be used, in conjunction with hardware, in various embodiments of the invention to "perform LPHDR operations disclosed herein," or that software can be used to emulate the "functions disclosed herein." In short, the specification allows for software to either facilitate or emulate the execution of LPHDR operations and functions. But that does not necessarily lead to the conclusion that the disclosed "LPHDR execution unit" must be an abstract concept that

encompasses all possible embodiments of the invention.

The other specification excerpt relied upon by Google likewise does not require a different result. That excerpt provides that "any of the techniques described above may be implemented, for example, in hardware, software tangibly stored on a computer-readable medium, firmware, or any combination thereof." ('273 patent col. 29 ll. 16-19). Google contends that the excerpt makes clear that the LPHDR execution unit must be amenable to implementation in all those forms and that "software is covered by every LPHDR execution unit claimed in the asserted patents based on the specification's teaching." (Google Post-Hr'g Br. at 10). That contention, though, is contradicted by the language of the specification, which teaches that "any of the techniques described" may be implemented in various forms.

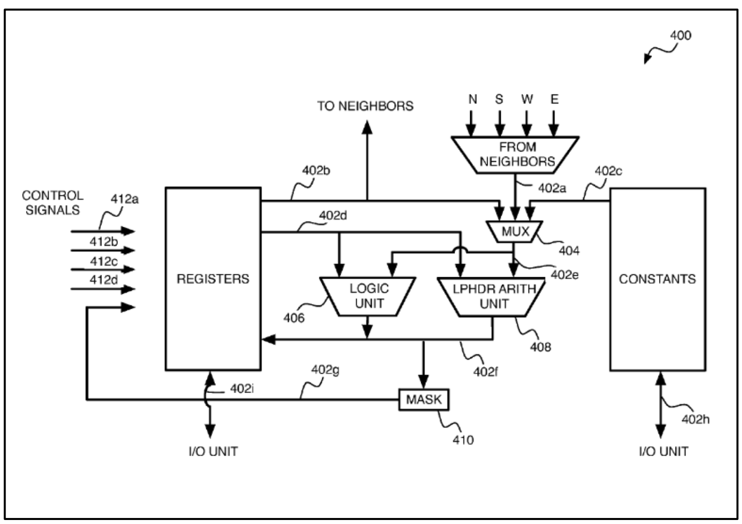
In any event, Google's interpretation of the specification and the asserted claims is at odds with the aspect of the disputed claim term upon which the parties agree—that the term "execution unit" can be construed as a "processing element." The specification uses the term "processing element" as though it were a tangible object. *See e.g.*, '273 patent col. 3 ll. 59-63 ("Small bit widths allow the processing elements to be small, which allows more of them to fit in the computer . . . ."), col. 6 ll. 51-55 ("Because LPHDR processing elements are relatively small, a single processor or other device may include a very large number of LPHDR processing elements, adapted to operate in parallel with each other, and therefore may constitute a massively parallel LPHDR processor or other device."), col. 6 l. 63-col. 7 l. 4 (". . . massive amounts of even high precision computation on a single chip or in a single machine, as is enabled by a compact arithmetic processing unit, is not useful without a corresponding increase in bandwidth between processing elements within the machine . . . .").

Furthermore, the example processing elements taught by the specification describe the

processing element as a tangible object comprising an arithmetic circuit paired with a memory circuit. For example, one "very general embodiment of an LPHDR machine" taught in the specification is described as follows:

> Our model of the machine is that it provides at least the following capabilities: (1) is massively parallel, (2) provides LPHDR arithmetic possibly with noise, (3) provides a small amount of memory local to each arithmetic unit, (4) provides the arithmetic/memory units in a two-dimensional physical layout with only local connections between units . . . , and (5) provides only limited bandwidth between the machine and host machine. Note that this model is merely an example which is used for the purpose of demonstrating the utility of various embodiments of the present invention, and does not constitute a limitation of the present invention. . . . While we are thus showing that LPHDR arithmetic is useful for a broad range of designs, of which [single instruction stream/multiple data stream designs] is only an instance, for purpose of discussion below, we call each unit, which pairs memory with arithmetic, a Processing Element . . . ."

(*Id.* col. 16 ll. 31-56). Similarly, Figure 4 of the patent provides intrinsic evidence to the same effect:




**'273 Patent, Fig. 4**

As described in the specification, Figure 4 depicts a processing element that pairs the LPHDR arithmetic element with memory circuits—here labeled as "Registers" (for frequently changing mathematical values) and "Constants" (for values that rarely change). (*Id.* col. 10 ll. 39-42). The specification makes clear that the processing element represented in Figure 4 "stores local

data" and that the amount of memory stored "varies significantly from design to design." (*Id.* col. 10 l. 34-37). Taken as a whole, the specification does not teach that the term "execution unit" must encompass all embodiments of the claimed invention, both tangible and intangible, as Google contends it must. To the contrary, the specification teaches, through generalized examples, to a person of skill in the art that the processing element is a tangible object that comprises arithmetic and memory circuits.

It is true, of course, that the specification describes embodiments of the claimed invention, not limitations on the claim language. *Martek Biosciences Corp.*, 579 F.3d at 1381. Further, courts must be vigilant in not unduly importing limitations from the specification into the claim language. *Phillips*, 415 F.3d at 1323. Nevertheless, "it is important to keep in mind that the purposes of the specification are to teach and enable those of skill in the art to make and use the invention and to provide the best mode for doing so." *Id.* Here, it appears that a person of skill in the art, reading the specification in its entirety, would interpret the term "execution unit" to comprise a device with access to a memory circuit.

That determination is not otherwise undermined by the extrinsic evidence offered by the parties. It is true that the treatise cited by Google states that "*[p]rocessing elements (PEs)* usually perform simple, memoryless mappings of the input values to a single output value"; among the examples it gives are addition and subtraction. Lars Wanhammar, *DSP Integrated Circuits* 366 (1999). It goes on to state that "[w]e will reserve the more general term *processor* to denote a PE with its internal memory and control circuitry." *Id.* Google's extrinsic evidence does not indicate that the term "processing element" necessarily denotes a device that lacks internal memory, but rather that the term can potentially describe a device that performs "memoryless mappings of []input values to a single output value." *Id.* In contrast, the treatise

cited by Singular refers to a "processing element" as having both arithmetic logic units and memory registers. John L. Hennessy & David A Patterson, *Computer Architecture: A Quantitative Approach* 584 (6th ed. 2019).

Again, despite that potential conflict, it appears that a person of ordinary skill in the art reviewing the patent would conclude that the claimed "execution unit" is a "processing element comprising an arithmetic circuit paired with a memory circuit." Although "extrinsic evidence may be useful to the court," it bears noting that "it is unlikely to result in a reliable interpretation of patent claim scope *unless considered in the context of the intrinsic evidence*." *Phillips*, 415 F.3d at 1319 (emphasis added). Based on the treatise cited by Google, it appears that very simple functions can be performed by an arithmetic logic unit without access to a memory circuit, and that the term "processing element" might be fairly used to describe a device that performs such simple functions. But in light of the sophistication of the operations at issue, and the description set out in the specification, there is no apparent reason why a person of ordinary skill in the art would interpret the term "execution unit" in the patent as comprising devices without access to a memory circuit.

In short, Google has not proffered persuasive evidence that the term "execution unit" should be interpreted so broadly as to encompass processors without access to memory. The Court will therefore adopt Singular's proposed construction of "execution unit" to mean "processing element comprising an arithmetic circuit paired with a memory circuit."

### 3. "Designed to Perform Arithmetic Operations"

Google also proposes that the term "execution unit" should be construed as a "processing element designed to perform arithmetic operations on numerical values." It contends that its construction provides greater clarity as to the function performed by the execution unit. (*See* Google Preliminary Br. at 16).

In contrast, Singular contends that Google's proposed construction would interject ambiguity into, and even directly contradict, the claim language. (Singular Preliminary Br. at 11). Specifically, the introduction of the term "arithmetic operation" into the claim would render ambiguous the meaning of "operation" as the claim discloses, within the same sentence, an execution unit that is " . . . adapted to execute a first operation on a first input signal . . . ." (*Id.*). Ostensibly, confusion would arise as to whether the execution unit operates on electrical signals or mathematical values. Singular also contends that Google's construction would impermissibly limit the scope of the claim to "arithmetic operations" when the claim language does not so limit the execution unit. (*Id.*)

Here, the parties dispute, in essence, not what the execution unit is, but rather how it works—a dispute that overlaps with the parties' proposed constructions of "a first input signal representing a numerical value." The proposed constructions will therefore be discussed below within the context of the remaining disputed term.

### C. <u>"First Input Signal Representing a Numerical Value"</u>

| **Claim Term** | **Google's Proposed Construction** | **Singular's Proposed Construction** |
|---|---|---|
| "a first input signal representing a numerical value" | "a digital and/or analog representation of a value that the LPHDR execution unit operates on" | Plain and ordinary meaning |

Google contends that its proposed instruction clarifies the claim language in two respects: (1) it specifies the kinds of electrical input signals received by the LPHDR execution unit, and (2) it harmonizes the disputed term with other claim language by distinguishing between electrical input signals and the mathematical values that those signals represent.

As to the first clarification, Google contends that the input signals received by the

LPHDR execution unit must either be in digital or analog form. (Google Preliminary Br. at 17). In response, Singular asserts that Google's construction would unduly impose a limitation not found in the claim language. (Singular Reply Br. at 14). Singular points to language in the specification that states, "[E]mbodiments of the present invention may represent values in any of a variety of ways, such as by using digital or analog representations, such as fixed point, logarithmic, or floating point representations, voltages, currents, charges, pulse width, pulse density, frequency, probability, spikes, timing, or combinations thereof." ('273 Patent col. 24 ll. 47-53). According to Singular, the listing of digital and analog signals in the passage is illustrative, not exhaustive. While it is by no means clear that the specification teaches any electrical "signals" that could be classified as other than digital or analog, Google has provided no compelling reason why the term requires construction in that respect.

In any event, it seems apparent that the signals are properly characterized as "electrical" signals. According to the specification, the impetus for the claimed invention arose from the fact that modern processor chips failed to make efficient use of their transistors because processors were designed to conduct precise arithmetic operations. (*See* '273 Patent col. 3 ll. 7-10, col. 5 ll. 30-62). The purported advantage of embodiments of the invention, according to the specification, is that they "efficiently provide computing power using a fundamentally different approach"—that is, by employing LPHDR arithmetic. (*Id.* col. 5 l. 63-col. 6 l. 2). Thus, if the benefit of the claimed invention is that it improves computer power by more efficiently harnessing the capabilities of a machine's transistors, it follows that the signals described in the claim must be electrical.

The second point of contention can be summarized as follows: Google construes the claim language such that the LPHDR execution unit operates on numerical values, which are

represented by electric signals, whereas Singular interprets the claim language such that the LPHDR execution unit operates on signals that represent numerical values. In this context, at least, that appears to be a distinction without a meaningful difference.

To begin, it is apparent that the LPHDR execution unit, as with all electronic computing devices, functions through the transmission of electrical signals across semiconductor chips, and that it is through those physical processes that the computer performs mathematical operations. Whether the LPHDR execution unit operates upon electrical signals or upon mathematical values, in this context at least, is largely a semantic distinction—the former describes the physical processes at work, while the latter describes the abstract representations inferred from those processes.

That semantic distinction, though, at least theoretically poses interpretive problems within the context of the asserted claims. The disputed claim language initially employs the term "input signal," which clearly denotes an electrical signal "representing a first numerical value." (*Id.* col. 31 ll. 64-66). It then discloses that the LPHDR execution unit executes a "first operation" on that signal, producing a "a first output signal representing a second numerical value." (*Id.* col. 31 ll. 66-67).

However, the claim proceeds to employ the terms "input" and "operation" in a manner that seems to conflate the physical processes with the mathematical concepts:

> . . . wherein the dynamic range of the possible valid inputs to the first operation is at least as wide as from 1/1,000,000 through 1,000,000 and for at least X = 5% of the possible valid inputs to the first operation, the statistical mean, over repeated execution of the first operation on each specific input from the at least X% of the possible valid inputs to the first operation, of the numerical values represented by the first output signal of the LPHDR unit executing the first operation on that input differs by at least Y = 0.05% from the result of an exact mathematical calculation of the first operation on the numerical values of that same input . . . .

(*Id.* col. 32 ll. 1-18, col. 32 ll. 37-41, 60-62).[6] Thus, Google correctly notes that there are apparent inconsistencies in the use of claim terms.

Nonetheless, Google's proposed construction does not provide greater clarity, as shown by a comparison of the claim language with that construction:

| Claim 53 | Google's Proposed Construction |
|---|---|
| "A device: comprising at least one first low precision high-dynamic range **(LPHDR) execution unit** adapted to execute a first operation on **a first input signal representing a first numerical value** to produce a first output signal representing a second numerical value . . . ." | "A device: comprising at least one first low precision high-dynamic range (LPHDR) **low precision high dynamic range processing element designed to perform arithmetic operations on numerical values** adapted to execute a first operation on a **digital and/or analog representation of a value that the LPHDR execution unit operates on** to produce a first output signal representing a second numerical value . . . ." |

The proposed construction arguably poses more problems than it solves, and it falls prey to the same inconsistencies as the claim language. To begin, the proposed construction does nothing to clarify whether the execution unit "operates" upon electrical signals or numerical values. It suggests that the execution unit is "designed" to perform arithmetic and "operates" upon mathematical values. But then, in the span of the same sentence, it describes the execution unit as "adapted" to execute a first "operation" upon inputted electrical signals. That inconsistency, as well as the redundancies Google interjects into the claim language, makes the proposed construction unacceptable.

[6] Singular contends that the cited claim language could refer to the physical processes as opposed to a mathematical operation. (*See* Singular Reply Br. at 17). It calls upon testimony from its expert that an electrical "first input signal" may possess a "dynamic range." (*Id.*; *see* Khatri Decl. ¶ 37). Whether that is possible in the most technical sense is beside the point. The patent discusses at length high-dynamic range *arithmetic*; indeed, the essence of the claimed invention is the processes for conducting low precision and high-dynamic arithmetical operations.

In any event, the critical issue is whether the apparent inconsistencies actually introduce any genuine ambiguity into the claim. Certainly, Google has offered little, if anything, to show that the claim language would actually confuse or create an ambiguity to a person of skill in the art.[7] It appears to the Court, at least, that the distinction between a signal (which represents an abstract value) and a value (which exists in the physical form of an electrical signal) is meaningless in this context, and it seems even less likely that any person of skill in the art would find the language confusing, ambiguous, or unclear. Put another way, if a person of skill in the art would find the claim language problematic, Google does not convincingly explain how or why.

Accordingly, the Court will construe the disputed claim language according to its plain and ordinary meaning.

## IV. <u>Conclusion</u>

For the foregoing reasons, the Court finds that the term "repeated execution" does not fail for indefiniteness, and the disputed claim terms in the disputed patents will be construed as follows:

1. "low precision and high dynamic range" as defined in the claim itself;
2. "execution unit" to mean "processing element comprising an arithmetic circuit paired with a memory circuit;" and
3. "a first input signal representing a numerical value" according to its plain and ordinary

[7] Google contends that the Court should adopt its proposed construction because it avoids ambiguity that might arise due to the lack of an antecedent basis for the disputed terms. (Google Preliminary Br. at 19 (citing *Process Control Corp. v HydReclaim Corp.*, 190 F.3d 1350, 1356-57 (Fed. Cir. 1999))). However, Google does not contend that the claim is indefinite due to that lack of an antecedent basis. Even so, "the lack of an antecedent basis does not render a claim indefinite as long as the claim 'apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by [§ 112(b)].'" *In re Downing*, 754 Fed. Appx. 988, 996 (Fed. Cir. 2018) (quoting MPEP § 2173.05(e)). As discussed, the Court finds the language sufficiently clear that a person of skill in the art could ascertain the claim's scope.

meaning.

**So Ordered.**

/s/ F. Dennis Saylor IV
F. Dennis Saylor IV
Chief Judge, United States District Court

Dated: July 27, 2022